Electromagnetic Models and Software for the Nondestructive Evaluation of Carbon Nanotube Based Composites, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

The use of eddy-current methods to detect damage in aerospace structures,and to characterize materials is well established, and is a key item to ensure that the risk of structural failures meets the strict damage tolerance requirements established by NASA. This is especially challenging when one considers that common aerospace structures are made from such disparage materials as aluminum, titanium and steel alloys, as well as carbon-fiber reinforced polymers (cfrp) and carbon-nanotube reinforced polymers (cnrp) that are seeing increased applications at NASA. Further the structural environments can be quite complex, including compound curvatures and/or multiple layers that are fastened together, with potential damage being located in each of the multiple layers. To address this need, Victor Technologies has developed VIC-3D(R), a comprehensive eddy-current modeling code for solving forward and inverse problems in nondestructive evaluation (NDE). Certain problems in modeling forward and inverse problems produce huge data sets, often requiring days of computation. In this proposal, we will enhance VIC-3D(R) for near real-time large-scale nondestructive simulations and automated data reduction/analysis of large data sets. Furthermore, we will add models to VIC-3D(R) that will allow the characterization of cnrp composites by electromagnetic means nondestructively. The result will be the first such commercial code for characterizing advanced composites by electromagnetic means nondestructively.

ANTICIPATED BENEFITS
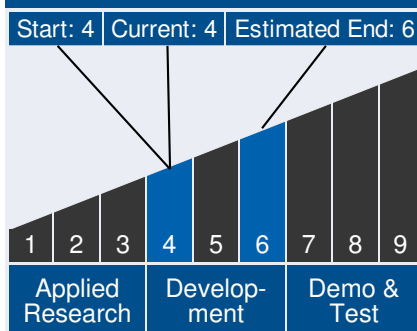
To NASA funded missions:

Potential NASA Commercial Applications: NASA LaRC already owns a copy of VIC-3D(R), which it uses for modeling forward and inverse problems in eddy-current NDE. With the enhancements proposed in this project, NASA LaRC will be able

Space Technology

Image Not Available

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Technology Maturity

Start: 4	Current: 4	Estimated End: 6

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Management Team

Program Executives:
- Joseph Grant
- Laguduva Kubendran

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to extend its modeling capability to handle carbon-nanotube reinforced polymer composite materials, as well as run large problems much more efficiently.

To the commercial space industry:

Potential Non-NASA Commercial Applications: There are over 30 commercial and university research institutions around the world that own copies of VIC-3D(R), which they use for the same purposes as NASA LaRC. They will have the same advantages with the enhanced version of VIC-3D(R). Furthermore, aerospace companies, such as Boeing, that are developing vehicles that use advanced composites, such as carbon-fiber reinforced polymers (cfrp), will be able to use the enhanced version of VIC-3D(R) to model carbon-nanotube reinforced polymers (cnrp), once NASA LaRC shows them the wisdom of doing so.
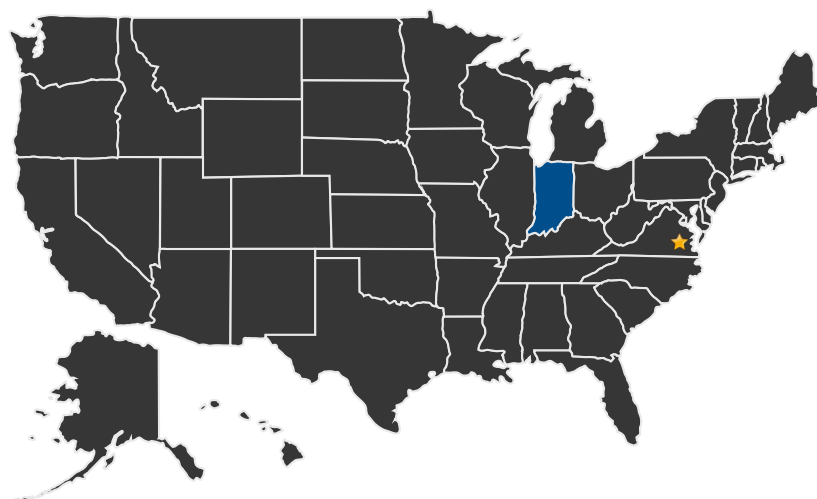
Management Team *(cont.)*

Program Manager:
- Carlos Torrez

Principal Investigator:
- Harold Sabbagh

U.S. WORK LOCATIONS AND KEY PARTNERS

■ U.S. States With Work

⭐ **Lead Center:** Langley Research Center

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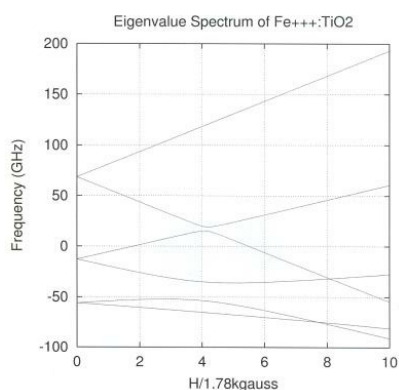
Other Organizations Performing Work:

- Victor Technologies, LLC (Bloomington, IN)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23116)

IMAGE GALLERY

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DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

NASA LaRC already owns a copy of VIC-3D(R), which it uses for modeling forward and inverse problems in eddy-current NDE. With the enhancements proposed in this project, NASA LaRC will be able to extend its modeling capability to handle carbon-nanotube reinforced polymer composite

Active Project (2016 - 2016)

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